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UREDINALES OF PORTO RICO BASED ON COLLECTIONS BY F. L. STEVENS

J. C. Arthur

The material illustrating the rust flora of Porto Rico, which was collected by Dr. F. L. Stevens and placed in my hands for study, represents a specially valuable contribution to the knowledge of tropical fungi. There were 650 numbers of the material submitted, which were mostly collected during the year 1913, only some twenty-three having been secured during the year 1912 and seven during January, 1914.

This is an especially notable achievement, as all other collections of rusts from the island taken together only slightly exceed 100. These range mostly through the last sixteen years. Among the previous collectors the two having the greatest knowledge of the *Uredinales* are Prof. E. W. D. Holway, leading with 25 collections made in January and February, 1911, and Dr. G. P. Clinton, following with 21 collections made in April, 1904. Some rusts have been included in collections made during the last few years by the botanists at the Experiment Station of the Porto Rico Sugar Growers' Association, about twenty-five of which have come to my attention.

Until the Stevens' material was available the general impression of the rust flora of Porto Rico has been that it was scanty and lacking in interest. Professor Holway, who is famous as a collector of microfungi, wrote from San Juan on January 29, 1911: "I have just come in from our trip across and around the island; rusts are very scarce." Again in a letter from Minneapolis, Minn., dated March 21, 1911, he writes: "I am just home from Porto Rico; I will send you the specimens soon. There are not many, but more than Sintenis got in his three years there." It now appears from the work of Dr. Stevens, however, that there are plenty of species in the island and some of exceptional interest, although the rust flora is not generally as conspicuous as is usual in temperate regions.

The 650 collections distribute themselves under 109 species of rusts, giving an average of about 6 collections to each species. Actual duplicates in the set are few, however. The several numbers under each species are often required for additional hosts, over 170 species altogether being represented, many not heretofore recorded as such, for illustrating successive stages of the fungus, some before unknown, and for distribution, over 65 localities having been visited.

The species previously known from Porto Rico do not exceed thirty-five in number, or about one third of the number secured by Dr. Stevens. The richness of Dr. Stevens' set is also attested by showing thirty-nine species, or over one third of his collection, as additions to the previously known rust flora of North America, of which number eighteen are new to science.

The family *Coleosporiaceae* is represented in Porto Rico by three species, of which *Coleosporium Plumierae* is distinctly West Indian. It is not, however, certain that this species is entirely autonomous, it may well be only a race of some earlier described species of wide range. Only cultures will fully elucidate this point. It is significant that no member of the genus *Pinus* occurs in Porto Rico. So far as known the species of *Coleosporium* form their aecia only on leaves of pines. It is practically certain that the three species in Porto Rico maintain themselves by the uredinial repeating spores, and are not indigenous to the island.

The family *Uredinaceae,* often called *Melampsoraceae,* is somewhat better represented. Five species are listed here. Two of these (under *Kuehneola*) have heretofore been invariably placed with the next family. The shift is made on account of the catenulate teliospores, in contradistinction to simple teliospores with one or more cells, and the resemblance of the uredinial sorus to that of *Pucciniastrum* in the manner of spore formation. The species of the family are like those of the preceding family in maintaining themselves by the uredinial repeating spores, only one, *Cerotelium Canavaliae,* being known to produce telia in the West Indies, and for none of them is the aecial condition known. There are five other forms listed under the form-genus

Uredo, which doubtless belong in this family. One of these forms, *Uredo fenestrala,* possesses a peridium having elongated cells at the sides and isiodiametric cells above, as in the genera *Schroeteriaster* and *Hyalopsora.* The other four forms, Nos. 105, 106, 107 and 108, have a pseudoperidium formed of imbricated paraphyses, which indicates a position near *Kuehneola* and *Physopella.* Possibly the fern rust, *Uredo Gymnogrammes,* also belongs near these forms. If all these were to be counted in, we would have eleven species under the family *Uredinaceae.*

The family *Aecidiaceae* (*Pucciniaceae*) contains the chief part of the Porto Rican rusts. There are sixty-three species so assigned in the following enumeration, of which one, *Pucciniosira pallidula,* is usually placed under the *Uredinaceae,* but is here shifted to the *Aecidiaceae* on account of the structure of the sorus. To these sixty-three should be added the species under the form-genus *Aecidium,* and such of those under *Uredo* as have not just been assigned to the other families, or eighty-five species in all. It is probable, however, that some of the species under the two form-genera merely represent stages of species already named under *Uromyces* or *Puccinia.* It almost amounts to a certainty that the ten species of *Aecidium* represent aecial forms to be distributed among the fifteen grass and sedge rusts enumerated, or those yet to be found. It is doubtless safe to assume, that omitting the names eventually to be reduced to synonymy, we ought to have remaining from this list about seventy-five species under the family *Aecidiaceae.*

The collection made by Dr. Stevens proved so representative of the Porto Rican rust flora in particular and of the West Indian in general that it has required little additional space to mention all other collections from the region known to the writer. No careful attempt has been made to secure all references made in literature, where the material was not available for examination. It is believed, however, that the presentation here made is a fairly exhaustive record of the West Indian *Uredinales.* After the enumeration of species in the Stevens collection, a list of twelve species is given, which embraces all material from Porto Rico secured by other collectors, so far as the writer knows, that was not represented in the Stevens collection. We may say, therefore, that the present known rust flora of Porto Rico numbers 121 species or, eliminating possible duplication (ten species of *Aecidium*), 111 species.

From all the other West Indian islands (excluding Trinidad) an additional nineteen species have come to light, which are given in a separate list. This makes 140 species of rusts for the West Indies, or by omitting undistributed aecia 130 species. Doubtless a few species already recorded have been overlooked. Unquestionably many species yet await the collector.

The writer desires to express his appreciation of Dr. Stevens' courtesy in supplying his material so unreservedly for study, and for information of various kinds regarding the island flora. He also wishes to extend thanks to the staff of the New York Botanical Garden, and to Prof. A. S. Hitchcock, Agrostologist of the U. S. Department of Agriculture, and to others who have assisted in the determination of the hosts. Especial recognition is due Mr. Percy Wilson of the N. Y. Bot. Garden for the unlimited patience and ready acumen, which he brought to bear in working over the great number of fragmentary specimens, and searching out corroborative or illustrative material from the phanerogamic herbarium, in order to determine the hosts with certainty and to extend knowledge of the range of the rusts.

FAMILY: **Coleosporiaceae**

1. COLEOSPORIUM ELEPHANTOPODIS (Schw.) Thüm. Myc. Univ. *953*. 1878.

ON CARDUACEAE:

Elephantopus mollis H.B.K., Maricao, Jan. 10,* *201*, Jan. 15, *287*, April 3, *869*; Corozal, Feb. 21, *411*; Yauco, Oct. 3, *3154*, *3248*; Jajome Alto, Dec. 3, *5638*; Jayuya, Dec. 17, *5997*; Mayagüez, Dec. 25, *6294*; River junction below Utuado, Dec. 30, *6600a*; St. Ana, Dec. 31, *6623*; Preston's ranch near Naguabo, Dec. 31, *6682*; without locality or date, *513*.

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* All dates in citation of the Stevens Porto Rican material are to be considered in the year 1913, unless otherwise stated.

The species has also been collected on *E. mollis* at Mayagüez, by A. A. Heller, Feb. 9, 1900, II & III, *4569*, at Bayamon, by E. W. D. Holway, Jan., 1911, and at Rio Piedras, by Johnston & Seaver, Dec., 1913, II, *1108*. It was a portion of the Heller collection that is the basis of the entry in N. Am. Flora, vol. 7, p. 90, under *Elephantopus scaber,* a species not represented in the American flora, but belonging to the Eastern Hemisphere, although both North and South American collections have been reported under that name.

Material has also been examined on *E. mollis* from Cuba and Jamaica, and on *E. angustifolius* Sw. from St. Vincent.

2. COLEOSPORIUM IPOMOEAE (Schw.) Burr. Bull. Ill. Lab. Nat. Hist. **2**: 217. 1885.

ON CONVOLVULACEAE:

Ipomoea Batatis Lam., Preston's ranch near Naguabo, Dec. 31, II, *6668*.
Ipomoea Nil Roth, Guayanilla, Nov. 13, II, *5898*.
Jacquemontia tamnifolia (L.) Griseb., Rio Piedras, Nov. 10, II, *5728*.

Material has also been examined on *Ipomoea littoralis* Blume, from San Juan, Jan., 1911, II, E. W. D. Holway, on *I. stolonifer* (Cyrill) Poir., from Vieques Island, Jan., 1914, II, J. A. Shafer *2406*, on *Quamoclit coccinea* (L.) Moench, Vieques Island, Jan., 1914, II, J. A. Shafer.

Collections have been seen on *I. Nil* and *Q. coccinea,* from St. Croix, and on *J. tamnifolia,* from Cuba.

3. COLEOSPORIUM PLUMIERAE Pat. Bull. Soc. Myc. Fr. **18**: 178. 1902.

ON APOCYNACEAE:

Plumiera Krugii Urban, Maricao, Jan. 10, II, *290*, Oct. 20, 1912, II, *28c*; Monte Alegrillo, Nov. 14, II, *4525*.
Plumiera obtusa L., Mona Island, Dec. 20, 21, II, *6101*.

The two hosts have not before been reported for North America. A specimen on *P. obtusa* has been received from Mel. T. Cook, collected at Santiago de las Vegas, Cuba, June, 1906.

The species was previously known on *P. alba* L. from Guadeloupe, and on *P. rubra* L., from Cuba.

FAMILY: **Uredinaceae (Melampsoraceae)**

4. PHYSOPELLA VITIS (Thüm.) Arth. Result Sci. Congr. Bot. Vienne 338. 1906.

Uredo Vitis Thüm. Pilze Weinst. 182. 1878.

Uredo Vialae Lagerh. Compt. Rend. Acad. Sci. Paris **110**: 729. 1890.

Phakopsora Vitis Sydow, Hedwigia Beibl. **38**: 141. 1899.

ON VITACEAE:

Vitis vinifera L., Pastillo Springs, Nov. 10, *5718*; Mayagüez, Dec. 26, *6304*, Jan. 5, 1914, *6731*.

Until full life history is known any generic assignment of species must generally remain somewhat doubtful. The only question involved in making the record in the present instance is whether or not this species, which was the type of the genus *Physopella,* differs sufficiently in important characters to keep it out of the earlier genus *Phakopsora,* to which it is assigned in Sydow's Monog. Uredinearum (**3**: 410. 1914). *Phakopsora* has a similar telial sorus, but the uredinial sorus, according to Magnus, Sydow, and others, for the writer has not seen suitable material, possesses a peridium opening by a central pore, whereas in the species on *Vitis* the uredinial sorus possesses peripheral free paraphyses. In no genus well established by species of fully known life histories is such an association of characters known. The species on *Vitis* is, therefore, listed under *Physopella,* rather than under *Phakopsora,* as better representing present knowledge of distinctions, while at the same time disavowing assumption of relationships. This limitation of the generic character of *Physopella,* taken in connection with other information brought to light since the establishment of *Physopella* as a genus in 1906, throws out all species that are listed under the genus in the N. Am. Flora, except the type.

So far the species in the West Indies has only been found on the cultivated grape, and only in the uredinial stage. It has been collected near Kingston, Jamaica, by G. von Lagerheim in

1889, by T. D. A. Cockerell in 1892, and by F. S. Earle in 1902. A collection was made at Havana, Cuba, by E. W. D. Holway in 1903.

5. KUEHNEOLA FICI (Cast.) Butler, Ann. Myc. **12**: 76. 1914.
Uredo Fici Cast.; Desmaz. Pl. Crypt. *1662*. 1848.
Uredo ficicola Speg. Anal. Soc. Ci. Argent. **17**: 120. 1884.
Uredo ficina Juel, Bih. K. Sv. Vet.-Akad. Handl. **23(3)**^{10}: 25. 1897.
Uredo moricola P. Henn. Hedwigia **41**: 140. 1902.
Physopella ficina Arth. N. Am. Flora **7**: 103. 1907.
Physopella Fici Arth. N. Am. Flora **7**: 103. 1907.

ON ARTOCARPACEAE:

Ficus laevigata Vahl, Santurce, Jan. *22*, *257* (Barth. N. Am. Ured. *920*); Vega Baja, Feb. *20*, *461*, May 18, *2044*, Dec. 31, *6621*, Mona Island, Dec. 20, *21*, *6078*, *6179*, *6423*; Cabo Rojo, Dec. *27*, *6461*; River junction below Adjuntas, Dec. 30, *6614*.

Ficus sp. indet., Jayuya, March 1, *426*.

This species was also collected on *Ficus Carica* L., at San Juan, Porto Rico, May, 1903, F. S. Earle, *33*.

Although this rust is doubtless common wherever figs are grown, yet the only other collections that are represented in the Arthur Herbarium from the West Indies are from Santiago de las Vegas, Cuba, on *F. Carica,* by W. T. Horne, March 13, 1906, and by Mel. T. Cook, July 21, 1906.

Until recently no teliospores of this species have been known. They were found in India by E. J. Butler (l. c.) on *Ficus glomerata.* Mr. Butler has given a good description of the fungus, with a figure showing germination of the teliospores. The assignment of the species to *Kuehneola* seems the best disposition of it that can be made at present. It should be borne in mind, however, that the position of the species remains doubtful so long as the full life history is not known. It may be assumed that pycnia and primary uredo may occur in a region where teliospores are produced, but when teliospores are absent and the reproduction is by secondary uredo there is no possibility of pycnia occurring.

The two species of *Ficus* rust described in N. Am. Flora (**7**: 103. 1907) are here united. It was found in carefully studying the ample collections by Dr. Stevens that they showed great variation in size of spores and development of paraphyses. Upon comparing data from all sources available there remained no doubt that only one species is represented, whether paraphyses with thick or thin walls are present in full development or practically absent, or whether the spores are larger or smaller, etc.

The genus *Kuehneola* is here associated with *Physopella, Phakopsora, Pucciniastrum,* etc., in the *Uredinaceae,* instead of with *Phragmidium* in the *Aecidiaceae,* as heretofore. The change is made on account of the evident unpedicelled, catenulate teliospores, corresponding to those of *Melampsoropsis* and other genera of the former family, but clearly alien to the *Aecidiaceae.*

6. KUEHNEOLA GOSSYPII (Lagerh.) Arth. N. Am. Flora **7**: 187. 1912.

Aecidium desmium Berk. & Br. Jour. Linn. Soc. **14**: 95. 1873.
Uredo Gossypii Lagerh. Jour. Myc. **7**: 48. 1891.

ON MALVACEAE:

Gossypium barbadense L., Isabela, Nov. 22, *5226*; Mona Island, Dec. 20, 21, *6141*.

Gossypium brasiliense Macf., River junction below Utuado, Dec. 7, *6052*.

The rust was found on *G. hirsutum* L. at Mayagüez, P. R., May, 1903, by F. S. Earle, *78*.

The only other specimen in the Arthur Herbarium from the West Indies is one collected on a species of tree cotton at Santiago de las Vegas, Cuba, Aug., 1904, by C. F. Baker (Barth. Fungi Columb. *2489*), although the rust is doubtless rather common in the warm regions adapted to cotton growing.

7. **Milesia columbiensis** (Dietel) comb. nov.

Milesina columbiensis Dietel; Mayor, Mem. Soc. Neuch. Sci. **5**: 559. 1913.

ON POLYPODIACEAE:

Nephrolepis rivularis (Vahl) Urban, without locality, Nov., *4504*; Agucaltaria, Nov. 25, *4855*.

The collections here listed were the first North American representatives of the genus seen by the writer, but they were followed almost immediately by a collection of **Milesia Kriegeriana** (Magn.) comb. nov. (*Milesina Kriegeriana* Magn.) on *Aspidium marginale,* from Hudson, Quebec, Canada, communicated by W. P. Fraser, who made the collection in June, 1913.

Up to the present time the only other North American collection known to the writer, that should be placed in the genus, was found on a specimen of *Dryopteris patens* (Sw.) Kuntze in the fern collection of the N. Y. Bot. Garden, obtained at Whitfield Hall, Jamaica, 3,000 feet altitude, April 20, 1903, L. M. Underwood *2522*. The species appears to be similar to *M. Kriegeriana,* but sufficiently distinct to merit a separate name. It may be called **Milesia consimilis** sp. nov., and characterized by the ellipsoid or obovoid urediniospores, being 16–21 by 26–29 μ, with colorless wall, 2.5–3.5 μ thick, moderately to sparsely echinulate with rather large points. The peridium is similar to that in *M. Kriegeriana.*

I am using the genus name *Milesia,* as I believe it was properly established upon the most distinctive spore form that could have been selected (Cf. Science **40**: 935. 1914), and that the rechristening by Magnus (Ber. Deut. Bot. Ges. **27**: 325. 1909) was superfluous, although conforming to the ruling of the Brussels Congress.

8. CEROTELIUM CANAVALIAE Arth. Bull. Torrey Club **33**: 30. 1906.

ON FABACEAE:

Canavalia ensiformis DC., Mayagüez, May 4, II, *1833*; Manati, Nov. 5, II, *4321*.

The species has heretofore only been known from the type collection, which was made at Mayagüez, P. R., April 16, 1904, by G. P. Clinton.

FAMILY: **Aecidiaceae (Pucciniaceae)**

9. RAVENELIA CAULICOLA Arth. N. Am. Flora **7**: 143. 1907.

ON FABACEAE:

Cracca cinerea (L.) Morong, Desecheo, May 31, II, *1621*; Quebradillas, Nov. 22, II, *5016*.

Only two other collections of this West Indian rust are known to the writer. One was found at Cataño, P. R., Feb. 14, 1914, by Johnston & Seaver, *1370*, and the other is the type collection, which was taken from a phanerogamic specimen in the Field Museum, Chicago, obtained by Britton & Millspaugh at Cave Cay, Bahamas, Feb. 19, 1905. Both collections are on *Cracca cinerea*.

10. RAVENELIA INDIGOFERAE Tranz. Hedwigia 33: 369. 1894.

ON FABACEAE:

Indigofera suffruticosa Mill. (*I. Anil* L.), Boqueron, Feb. 15, II, *340*, II, *355*; Bayamon, Feb. 16, II, *399*; Jayuya, March 31, *692*; Mayagüez, Aug. 13, II, *3021*; Aguada, Nov. 22, *5106*.

It was also collected on the same host at Cataño, P. R., Feb. 14, 1914, by J. R. Johnston *1368*.

The other West Indian islands represented in the Arthur Herbarium are Bermuda, by W. G. Farlow, Jan., 1881; Cuba by W. T. Horne, March 15, 1905, and April 5, 1906, by C. F. Baker, Jan. 15, 1907 (Barth. Fungi Columb. *2475*), all three from Santiago de las Vegas; and Jamaica, by F. S. Earle, *33*, E. W. D. Holway, Feb. 17, 1915, *215*, all the collections being on *I. suffruticosa*.

11. RAVENELIA INGAE (P. Henn.) Arth. N. Am. Flora 7: 132. 1907.

ON MIMOSACEAE:

Inga vera Willd., Monte Montosa, Oct. 13, 1912, *976*, Oct. 14, 1912, *28d*; Monte Alegrillo, June 20, *2376*.

The fungus on the same host has also been collected in Porto Rico at Ponce, O. W. Barrett, Aug., 1904. No other West Indian collections are known to the writer.

On some of the leaves the fungus forms loose brown masses, consisting mostly of spores, that have the appearance of insect ejecta. The resemblance is aided by the leaf being puffed and broken at these places, the spots often being a centimeter across.

12. **Ravenelia Stevensii** sp. nov.

Pycnia not seen.

Uredinia hypophyllous, numerous, scattered, round, small, 0.1–0.3 mm. across, subcuticular, early naked, dull cinnamon-brown, ruptured cuticle inconspicuous; paraphyses in a thick peripheral ring, upright, capitate to clavate, 9–12 by 37–45 μ, smooth, wall of head 2–5 μ, cinnamon-brown, passing into the thin-walled, colorless stipe; urediniospores oblong, cylindric-oblong, or narrowly obovoid, 8–13 by 25–30 μ; wall cinnamon-brown, paler below, uniformly thin, less than 1 μ, slightly thicker above, very finely and inconspicuously verrucose-echinulate, the pores usually indistinct, about 4, equatorial.

Telia hypophyllous, few, very small, subcuticular, blackish-brown; teliospore-heads chestnut-brown, 3–6 cells across, 40–63 μ across, each spore bearing 1–3 nearly hyaline tubercles, 2–3 μ thick, 6–19 μ long, 2–3 forked above; cysts hyaline, globoid, extending from periphery to pedicel, not bursting in water; pedicel hyaline, short, usually wanting.

ON MIMOSACEAE:

Acacia riparia H.B.K., Guayanilla, Nov. 13, II, III, *5881* (type); Vega Baja, Feb. 22, II, *366*, May 18, II, *2047*; Peñuelas, Nov. 8, II, *4895*.

This very distinctive species of *Ravenelia* is dedicated to Dr. F. L. Stevens, who has not only made all the collections of it so far known, but has supplied a wealth of material representing Porto Rican Uredinales far exceeding that of all previous collectors, as the present paper amply testifies.

13. PROSPODIUM APPENDICULATUM (Wint.) Arth. Jour. Myc. 13: 31. 1907.

Puccinia appendiculata Wint. Flora **67**: 262. 1884.

ON BIGNONIACEAE:

Stenolobium Stans (L.) D. Don. (*Tecoma Stans* Juss.), Hormigueros, June 23, II, *2494*.

The other West Indian collections seen by the writer are by E. W. D. Holway in Cuba at Holquin and at Havana, 1903, by Dr. Stevens in Martinique, Aug. 4, 1913, *2974*, all three on *S. Stans* and all showing uredinia only, and one by Holway in Jamaica, on *S. Stans,* Feb., 1915, *222*, showing II & III.

14. **Argomyces insulanus** sp. nov.

Pycnia epiphyllous, subepidermal, few in crowded groups, globoid-flask-shaped, 105–175 by 170–200 μ.

Aecia uredinoid (primary uredo), hypophyllous, few surrounding the pycnia, sometimes confluent; aeciospores somewhat larger than the urediniospores. Otherwise same as the uredinia.

Uredinia hypophyllous, few, scattered, round or oblong, small, 0.3–0.5 mm. long, early naked, pulverulent, dull cinnamon-brown, ruptured epidermis evident; urediniospores ellipsoid or obovoid, 19–26 by 26–35 μ; wall cinnamon-brown, moderately echinulate, 1.5–2.5 μ thick, the pores usually three, equatorial or slightly subequatorial, indistinct.

Telia hypophyllous, few, usually scattered, round to oblong, 0.3–0.8 mm. long, early naked, dull cinnamon-brown, germinating at maturity, ruptured epidermis evident; teliospores broadly ellipsoid to ellipsoid-fusiform, 19–30 by 42–60 μ, obtuse, or somewhat attenuated at both ends, slightly constricted at septum; wall pale cinnamon-brown, thin, 1–1.5 μ, with a low hyaline papilla over the pore, disappearing at germination, smooth, the pore in lower cell near the septum; pedicel slender, colorless, once length of spore or less.

ON CARDUACEAE:

Vernonia albicaulis Pers., River junction below Utuado, Dec. 30, O, II, III, *6596* (type), O, II, III, *6589.*

Vernonia longifolia Pers., Villa Alba, Jan. 3, III, *113.*

This species differs from *Arg. Vernoniae* by the broad and much larger teliospores. It is notably distinct from *Puccinia Becki* Mayor and *P. Vernoniae-mollis* Mayor, both from Colombia, S. A., the former having very long, slender teliospores, and the latter very small teliospores.

Arg. insulanus also occurs on the island of St. Croix. It was collected by A. E. Ricksecker in 1896, and recorded by Ellis & Kelsey (Bull. Torrey Club **24**: 208. 1897), under the name of *Puccinia Vernoniae* Cooke. The determination was considered doubtful at the time. Although the type of *P. Vernoniae,* which is African, has not been seen, yet there is slight chance of the West Indian and African forms being the same. Another representative of the St. Croix rust has been communicated by Mr. Percy Wilson, who found it on a phanerogamic specimen collected in St. Croix, Jan. 17, 1896, on *V. albicaulis,* by Marion

Hoy *220*. The host species of the Ricksecker collection is clearly identical with the Hoy collection.

15. ARGOMYCES VERNONIAE Arth. N. Am. Flora **7**: 218. 1912.

ON CARDUACEAE:

Vernonia borinquensis Urban, Consumo, April 27, O. II. III, *809*; Jajome Alto, Dec. 3, O, II, III, *5684*; El Gigante near Adjuntas, Dec. 15, II, III, *5962*.

Vernonia phyllostachya (Cass) Gleason, Cabo Rojo, Dec. 27, II, III, *6473*.

The species was described from a Porto Rican collection from Cayey, on *V. borinquensis,* by E. W. D. Holway, Jan., 1911. The Stevens collections are the first additions to the type material so far seen. The shape and the pore arrangement as given for the urediniospores in the original description appear to need some modification. The spores may be ellipsoid, and the pores more than four and not strictly equatorial.

16. UROMYCES ERAGROSTIDIS Tracy, Jour. Myc. **7**: 281. 1893.

Nigredo Eragrostidis Arth. Result. Sci. Congr. Bot. Vienne 343. 1906.

ON POACEAE:

Eragrostis tephrosanthus Schult., Bayamon, Feb. 21, II, *442*.

The species was collected on the same host by Mr. & Mrs. A. A. Heller at Rio Piedras, Jan. 17, 1899, *197*, which is the only other West Indian collection known to the writer.

17. UROMYCES LEPTODERMUS Sydow; Sydow & Butler, Ann. Myc. **4**: 430. 1906.

Puccinia (?) *panicicola* Arth. Bull. Torrey Club **34**: 586. 1908.

Nigredo leptoderma Arth. N. Am. Flora **7**: 224. 1912.

ON POACEAE:

Lasiacis divaricata (L.) Hitchc. (*Panicum divaricatum* L.), Coleña, Nov. 3, *4528*; Utuado, Nov. 8, *4608*; San German, Dec. 8, *4677*, Dec. 12, *5857*; Maricao, Nov. 18, *4793*; Mona Island, Dec. 20, 21, *6089*, *6145*, *6425*.

Lasiacis Sloanei (Griseb.) A. S. Hitch. (*Panicum Sloanei* Griseb.), Arecibo, Jan. 17, 1914, *6805*.

Panicum barbinode Trin. (*P. molle* Auct. not Swartz), Guanica, Feb. 1, *350*; Boqueron, Feb. 15, *350 bis;* Mayagüez, March 26, *447*, March 9, *480*; Peñuelas, Nov. 8, *4560*.

Only one of these collections, *6145* from Mona Island, shows teliospores, and that only sparingly so.

A collection determined by Prof. Hitchcock to be on *Lasiacis Swartziana* Hitchc. (*Panicum lanatum* Sw. not Rottb.) was collected by R. Thaxter, 1891, in Jamaica, and communicated by W. G. Farlow, which shows both uredinia and telia. Material representing the species has also been collected at Santiago de las Vegas, Cuba, on *P. barbinode* and thought at first to show only uredinia, but on which a few telia have recently been detected. *L. Sloanei* is a host for the species not before reported.

18. **Uromyces ignobilis** (Sydow) comb. nov.

Uredo ignobilis Sydow, Ann. Myc. **4**: 444. 1906.
Uromyces major Arth. Bull. Torrey Club **38**: 377. 1911.
Nigredo major Arth. N. Am. Flora **7**: 225. 1912.

ON POACEAE:

Sporobolus indicus (L.) R. Br., Mayagüez, II, April 30, *925*.

The Stevens material agrees exactly with the description of *Uredo ignobilis* Sydow, the type being on *Sporobolus diandrus* from Pusa, India, and with the collection by E. J. Butler from the type locality, distributed in Sydow, Uredineen *2199*. The spores of the Porto Rican material also agree with the four-pored, thick-walled urediniospores of *Uromyces major,* the type of which is on some species of *Muhlenbergia* from the vicinity of the City of Mexico. The genera *Sporobolus* and *Muhlenbergia* are only technically different, so that it is not surprising to find the same tropical rust on hosts belonging to both genera, and from very widely separated localities. The three stations mentioned are the only ones yet known for the species.

19. UROMYCES RHYNCOSPORAE Ellis, Jour. Myc. **7**: 274. 1893.

Nigredo Rhyncosporae Arth. Result. Sci. Congr. Bot. Vienne 344. 1906.

ON CYPERACEAE:

Rynchospora micrantha Vahl, Preston's ranch near Naguabo, Dec. 31, *6766*.

Porto Rican material on the same host has been seen from Tabucoa, taken from a phanerogamic collection by Boeckeler *5301*, Oct. 12, 1886, and on *R. aurea* Vahl, collected by G. P. Clinton, at Mayagüez, April 13, 1904.

Collections have also been examined on *R. cyperoides* (Sw.) Mart. from Bahamas, on *R. distans* (Michx.) Vahl, from Cuba and Bermuda, and on *R. polyphylla* Vahl, from Jamaica, all of which are noted in the N. Am. Flora, vol. 7, pp. 232, 233.

20. UROMYCES SCLERIAE P. Henn. Hedwigia Beibl. **38**: 67. 1899.

Nigredo Scleriae Arth. Result. Sci. Congr. Bot. Vienne 344. 1906.

ON CYPERACEAE:

Scleria pterota Presl. Luguillo forest, Dec. 2, *5552*.

Material has also been seen on the same host from Bayamon, E. W. D. Holway, Jan., 1911, and on an undetermined species of *Scleria* from near Santurce, A. A. Heller, Jan., 1903, *6447*.

21. UROMYCES COMMELINAE (Speg.) Cooke, Trans. Roy, Soc. Edinb. **31**: 342. 1888.

Uredo Commelinae Speg. Anal. Soc. Ci. Argent. **9**: 172. 1880.

Uredo Commelinaceae Ellis & Kelsey, Bull. Torrey Club **24**: 209. 1897.

Nigredo Commelinae Arth. N. Am. Flora **7**: 237. 1912.

ON COMMELINACEAE:

Commelina virginica L. (*C. elegans* H.B.K.), Desecheo, May 31, *1578c*.

The only other West Indian collection seen is on the same host from St. Croix, made in 1896 by A. E. Ricksecker, which was used as the type for Ellis & Kelsey's name.

In Mayor's work on the Colombian rusts this species is recorded from Jamaica on *Commelina nudiflora* and *Tradescantia multiflora.* It is doubtless a common rust throughout the tropical world, but too inconspicuous to be often collected.

The single collection of this species by Stevens shows only uredinia, as has been the case with most other collections. The type collection for Cooke's name, which has been examined through the kindness of the Director of the Kew Gardens, shows both telia and uredinia. This collection came from Socotra, an island at the mouth of the Gulf of Áden. Other collections with both telia and uredinia have been examined from the eastern border of Africa along the coast of the Red Sea, and also a collection from the Malabar Coast of western India. No telia are known on any collection from the western hemisphere; and no pycnia or aecia from any part of the world have been associated with the species. It was placed in *Nigredo* on the assumption that the morphological and host characters warranted the belief in pycnia and aecia of a certain form to complete the life cycle.

22. **Uromyces Caesalpiniae** (Arth.) comb. nov.

Ravenelia Caesalpiniae Arth. Bull. Torrey Club 31: 5. 1904.

ON MIMOSACEAE:

Mimosa ceratonia L., Bayamon, Feb. 19, O, II, III, *393*, March 2, *508 bis,* May 21, *1868*; Vega Baja, March 2, *508*, May 21, *1929*, Nov. 5, *4264*; Monte Alegrillo, June 20, *2335*; St. Catalina, Aug. 28, *2723*; Cabo Rajo, July 28, *3163*; Indiera Fria, Maricao, *3454*; Abonita, Nov. 3, *4020*; Vega Alta, November, *4153*; San Sebastian, Nov. 22, *4510*; Lares, Nov. 22, *4850*; Manati, *5306*; Luguillo forest, Dec. 2, *5432*; San German, Dec. 8, *5764*; El Gigante near Adjuntas, Dec. 15, *5970*; Preston's ranch near Naguabo, Dec. 31, *6657*.

The type material of *Ravenelia Caesalpiniae* Arth., now in the Arthur Herbarium, was scanty, consisting of two compound leaves, bearing together twelve leaflets, moderately supplied with pycnia and uredinia, but no telia. The collection was made near Bayamon, P. R., in 1901, by L. M. Underwood and R. F. Griggs, both excellent botanists. It was labeled by the collectors as "on *Caesalpinia.*" As the pycnia and uredinia closely simulate those of various species of *Ravenelia,* the material was named accordingly.

No other collections were brought to light until those by Dr. Stevens arrived, the earliest being from Bayamon, gathered Feb. 19 and March 2, 1913. This material showed telia, as well as pycnia and uredinia, and consisted of numerous leaves accompanied by pods. It was submitted to the New York Botanical Garden for determination of the host. In the meantime Dr. N. L. Britton examined the host in the field for Dr. Stevens and pronounced it to be *Mimosa ceratonia,* most probably, and this determination was repeatedly and independently confirmed at the New York herbarium by Mr. Percy Wilson.

Now that the full life-cycle of the species is known, it proves to be a most difficult one to place. If we consider the structure and formation of all three kinds of sori, the peculiar urediniospores with their paraphyses, and the host relationship, the rust is preponderatingly like a *Ravenelia,* but the teliospores are borne singly and simulate a *Uromyces.* With present knowledge there seems no better way to do than enter the species under *Uromyces.* Technically it would fall under *Klebahnia.* The specific name is an unfortunate one, but we hesitate to add another to synonymy. Description of the telia is here appended.

Pycnia and uredinia as given in N. Am. Flora 7: 141. 1907. Telia amphigenous, similar in size and appearance to the uredinia except much darker in color, chocolate-brown, subcuticular, ruptured epidermis noticeable; paraphyses wanting; teliospores obovoid, 15–20 by 24–34 μ, usually narrowed below, rounded or obtuse above, often with a hyaline papilla over the germ-pore; wall chocolate-brown above, much paler below, thin at the sides, 1 μ, thickened at apex, 3–5 μ, smooth; pedicel somewhat tinted, half length of spore or shorter, thick, 5–7 μ.

23. UROMYCES JAMAICENSIS Vesterg. Ark. Bot. Stockh. 4^{15}: 33. 1905.

ON CASSIACEAE (CAESALPINIACEAE):

Bauhinia pauletia Pers., San German, Jan. 19, *238,* Nov. 8, *5786,* Dec. 12, *5866*; Mayagüez, Oct. 31, *3924.*

A collection on the same species of host was also made at Mayagüez, January, 1911, by E. W. D. Holway.

The type of the species came from Jamaica, as the name indicates, and is on an undetermined species of *Bauhinia,* having a similar leaf to that of *B. pauletia,* but doubtless specifically different from it. The spores of the type are slightly smaller for the most part than are those from the Porto Rican material. One collection has been examined from Mexico on *B. divaricata.* All collections agree in showing only telia, and in having the appearance of a micro-form, that is, in being short-cycled and incapable of germination immediately upon maturity.

24. UROMYCES APPENDICULATUS (Pers.) Fries, Summa Veg. Scand. 514. 1849.

Nigredo appendiculata Arth. Result. Sci. Congr. Bot. Vienne 343. 1906.

ON FABACEAE:

Phaseolus adenanthus G. Meyer, Vega Baja, Feb. 22, *374 bis;* Mayagüez, May 8, *1139.*

Phaseolus vulgaris L., Cabo Rojo, June 15, *2270.*

Vigna repens (L.) Kuntze, Arecibo, May 21, *1760.*

Vigna vexillata (L.) A. Rich., Mayagüez, June 14, *2216.*

The species has also been collected in Porto Rico on *P. adenanthus* by E. W. D. Holway, Caguas, January, 1911, by Mr. & Mrs. A. A. Heller on a phanerogamic specimen, Rio Piedras, April, 1889, *1221,* and by Britton & Cowell on a phanerogamic specimen, near Arecibo, March 14, 1908, *308*; and also on *P. vulgaris* by F. S. Earle, La Carmelita, June, 1903, *110,* and by G. P. Clinton, same locality, Apr. 18, 1904, *124.* The last collection bears teliospores as well as urediniospores.

On phanerogamic specimens in the herbarium of the New York Botanical Garden the uredinial stage has been found on both *Vigna repens* and *V. vexillata* from Cuba.

While the pores in the urediniospores of this species are usually two or three, and equatorial, as given in the N. Am. Flora 7: 257, they are sometimes four in number, and sometimes are distinctly superequatorial. The Stevens' collections from Porto Rico show only uredinia, and the spores are 2-pored. On *Phaseolus* the pores are mostly equatorial, but on *Vigna* they are markedly superequatorial.

25. UROMYCES DOLICHOLI Arth. Bull. Torrey Club **33**: 27. 1906.
Puccinia Dolichi Arth. Bull. Torrey Club **33**: 28. 1906.
Uredo Dolichi Arth. Bull. Torrey Club **33**: 513. 1906.
Nigredo Dolicholi Arth. N. Am. Flora **7**: 258. 1912.

ON FABACEAE:

Cajan Cajan (L.) Millsp. (*Cajanus indicus* Spreng.), Guayanilla, Jan. 4, *87*; Corozal, Feb. 21, *418*; Jayuya, March 31, *693*; Rosario, Oct. 27, *3832*; Mayagüez, Oct. 27, *3861*; Vega Baja, Nov. 5, *4241*; Menati, Nov. 5, *4307*; Quebradillas, Nov. 22, *5119*.

Dolicholus reticulatus (Sw.) Millsp. (*Glycine reticulata* Sw., *Rhynchosia reticulata* DC.), Boqueron, Feb. 15, II, *337*; Aguada, Nov. 22, II, *5091*; Vega Baja, May 18, *2048*.

A collection was made on *D. reticulatus* by A. A. Heller at Limestone Hills near Bayamon, Jan. 21, 1903, and on *C. Cajan* by J. A. Stevenson *2474*, at Campoalegre, Dec. 22, 1914. The species has also been found on a phanerogamic specimen of *C. Cajan* from St. Domingo.

The type collection of this species is in the Arthur Herbarium at Lafayette, Ind., and was obtained at San Angelo, Texas, Oct. 19, 1904, by C. L. Shear. The host was determined by Dr. E. L. Greene as *Rhynchosia texana* T. & G., now called *Dolicholus texanus* (T. & G.) Vail. It consists of a few intertwined stems, and about twenty two small, well-rusted leaves. The same collection was issued in Bartholomew, Fungi Columbiani *4091*.

A re-examination of the type collection shows that a more exact statement in the description of the species would be to say *pores 2 to 4, usually three,* instead of "pores 4." This statement of the pore-character also better fits other collections recently studied, and especially the Porto Rican ones here listed.

The collection named *Puccinia Dolichi* from a few teliospores, afterwards found to be strays, and then called *Uredo Dolichi,* was made by E. W. D. Holway, at Aguacate, Cuba, March 23, 1903, and was labeled as on "*Dolichos reticulatus*." The genus *Dolichos*, according to Engler & Prantl, Pflanzenfamilien, is closely related to *Phaseolus* and *Vigna*, genera which bear *Uromyces appendiculatus*, and to this species the rust was accordingly assigned in the North American Flora, vol. 7, page 257. The authority, "Hochst." for the name of the host was supplied from the Kew Index. Recently, becoming suspicious of the correctness of the name, the type material was submitted to the New York Botanical Garden, and it has been determined by Mr. Percy Wilson, March 6, 1915, as *Dolicholus reticulatus* (Sw.) Millsp. The latter genus belongs to a different group of genera from that of *Dolichos*. The rust on the Cuban host agrees well with that from Texas, except that it shows only uredinia.

Two collections of this species from South America have been examined, and show uredinia which agree well with the North American material. One was collected by M. St. Pennington, near San Fernanda, Argentina, 1902, on *Rhynchosia Senna* Gill. The other was issued in Spegazzini's Dec. Myc. Arg. *20*, and was collected by Spegazzini in 1881, at Bagnado de San Jose de Flores, Argentina, on "*Rhyncosia*" sp. The two collections are given the same name, *Uredo pamparum*, and appear to be on the same host. The locality for the latter collection is the place where Spegazzini collected the type of *Uredo pamparum*, one year earlier. In Anal. Soc. Ci. Argent. vol. 9, page 173, this last species is established as on *Phaseolus prostratus*, a determination which for a variety of reasons the writer believes to have been an error for *Rhynchosia* (*Dolicholus*) *Senna*.

A collection of the same species of rust on still another species of *Rhynchosia*, thought to be *R. longeracemosa* Mart. & Gall., has been included in Mayor's Contribution à l'étude de Urédinees de Colombie, and said to agree well with the North American *U. Dolicholi*, under which name it is listed.

The several collections on *Cajanus indicus* show such close agreement in the spore and sorus characters with those on *Dolicholus reticulatus*, and the hosts being closely akin, there seems ample reason for placing them here. So far as one can judge from the description, *Uredo Cajani* Syd. (Ann. Myc. **4**: 442.

Oct., 1906) refers to the same rust. All West Indian collections so far seen on this host show uredinia only, usually with three equatorial pores in the urediniospore.

26. UROMYCES HEDYSARI-PANICULATI (Schw.) Farl.; Ellis, N. Am. Fungi *246.* 1879.

Uromyces solidus Berk. & Curt. Grevillea **3**: 57. 1874.

Nigredo Hedysari-paniculati Arth. Result. Sci. Congr. Bot. Vienne 343. 1906.

ON FABACEAE:

Meibomia axillaris (Sw.) Kuntze (*Desmodium axillare* DC.), Cabo Rojo, June 15, *2259.*

Meibomia Scorpiurus (Sw.) Kuntze (*Desmodium Scorpiurus* Desv.), Mayagüez, May 24, *1375*; Peñuelas, Dec. 15, *5936.*

The collections here included possess only uredinia, which are, however, in every way typical of the species. The spores are broadly ellipsoid, often globoid, 18–21 by 21–24 μ; wall chestnut-brown, about 1.5 μ thick, the pores 3–5, scattered, or sometimes appearing equatorial. Thin-walled, hyphoid, paraphyses are present.

This rust has not before been reported from the West Indies. I have, however, been able to detect it on phanerogamic collections in the herbarium of the New York Botanical Garden. It occurs on a specimen of *M. Scorpiurus* collected by A. A. Heller, near Yauco, P. R., Dec. 15, 1902, and on the same host collected by Percy Wilson, at Rio San Miguel, Cuba, Dec. 17, 1910, *9380.*

Through the kind assistance of Mr. Percy Wilson the rust has also been brought to light from the same source on *Meibomia tortuosum* (Sw.) Kuntze, collected at Yauco, P. R., Oct. 3, 1913, by Stevens & Hess, *3252*, and collected in Cuba, near Vento, 1907, Baker, Tracy & Hasselbring *3079*, and near Herradura, 1910, Britton & Earle *6591.*

The same rust on both *M. Scorpiurus* and *M. tortuosum* is known from the southern part of continental North America. All the collections here referred to show only uredinia, but they appear to be identical with authenticated material of the species.

It has not been possible to examine type material of *Uredo Desmodii-tortuosi* P. Henn. (Hedwigia **35**: 252. 1896), which was founded on a collection of *Meibomia tortuosum* from Fajardo, P. R., April 17, 1885, O. Sintenis. However, the claim of the author that it is distinct from *Urom. Hedysari-paniculati* by reason of its smooth spores, seems open to doubt. As no rust is known having truly smooth urediniospores, it is probable that Hennings' material possessed fine echinulation, which was overlooked. As all other terms of the characterization accord well with the common species on *Meibomia,* it may tentatively be assumed that the form named by Hennings is not essentially distinct.

27. UROMYCES NEUROCARPI Dietel, Hedwigia **34**: 292. 1895.
Uromyces insularis Arth. Bull. Torrey Club **33**: 515. 1906.
Nigredo Neurocarpi Arth. N. Am. Flora **7**: 258. 1912.
ON FABACEAE:
Clitoria cajanifolia (Presl) Benth. (*Neurocarpum cajanifolium* Presl), Mayagüez, Jan. 30, *344*; without locality or date (in letter dated June 18, 1913), *2146c*.
Clitoria rubiginosa Juss. (*C. glycinoides* P. DC.), Dorado, Nov. 25, *5314*, *5315*.

No pycnia or aecia have yet been discovered for this species, but it is highly probable that they occur occasionally. Telia, in addition to uredinia, are shown only on no. *344* of the specimens here listed.

The type collection of *U. insularis* was on *C. cajanifolia,* from Dorado, P. R., 1887. The species was also collected on this host near San Juan, in 1914, by Britton and Cowell *1469*. On *C. rubiginosa* it has been found at Santurce, P. R., Feb., 1914, by J. R. Johnston *1339*, and in both Jamaica (1906) and Cuba (1903).

28. UROMYCES PROËMINENS (DC.) Pass. Rab. Fungi Eur. *1795*. 1873.

Uromyces Euphorbiae Cooke & Peck; Peck, Ann. Rep. N. Y. State Mus. **25**: 90. 1873.

Uromyces euphorbiicola Tranz. Ann. Myc. **8**: 8. 1910.
Nigredo proëminens Arth. N. Am. Flora **7**: 259. 1912.

ON EUPHORBIACEAE:

Chamaesyce hirta (L.) Millsp. (*Euphorbia hirta* L., *E. pilulifera* L.), Cataño, Nov. 6, *4154*; Vega Baja, Nov. 5, *4325*; Lares, Nov. 22, *4839 bis;* Coamo Springs, Nov. 16, *4906*; Aricebo, Nov. 22, *5015*; Aguado, Nov. 22, *5104*; Guayama, Dec. 4, *5339*; Rio Piedras, Nov. 13, *5703*; San German, Nov. 8, *5804*; Guayanilla, Nov. 13, *5868*.

The species has also been collected on *C. hirta* at Mayagüez, by G. P. Clinton in April, 1904, *169*, and at Camuy, by Underwood & Griggs in July, 1901, *199*.

Material has been examined from other West Indian islands as follows: Bahamas, on *C. hypericifolia* (L.) Millsp., *C. prostrata* (Ait.) Small, and *Poinsettia heterophylla* (L.) Kl. & Garcke; Cuba, on *P. heterophylla;* Jamaica, on *C. hirta* (L.) Millsp., *C. prostrata, C. serpens* (H.B.K.) Small, and *P. heterophylla;* St. Croix, on *C. prostrata;* all of which collections but one are cited in the North American Flora, vol. 7, pp. 260, 261.

29. **Uromyces Janiphae** (Wint.) comb. nov.

Uredo Janiphae Wint. Grevillea **15**: 86. 1887.
Uromyces dichrous Vesterg. Micr. Rar. Sel. *1516*. 1913. Hyponym.

ON EUPHORBIACEAE:

Manihot Manihot (L.) Cockerell (*M. utilissima* Pohl, *Jatropha Manihot* L., *Janipha Manihot* H.B.K.), Vega Baja, Nov. 5, II, *4261*.

This rust appears to be common in the warm regions of America on various forms of the cultivated cassava. That it occurs in the Old World as well is probable, but I have seen no specimens. Winter's description was founded on material collected near Sao-Francisco, Brazil, in 1887, by E. Ule *362*. Vestergren's material was collected by E. W. D. Holway at Guadalajara, Mexico, in 1903, and is the only collection known to the writer showing both uredinia and telia. The original number of the collection is *5050*. The same collection has been issued in Vestergren's Micr. Rar. Sel. *1516*, and in Bartholomew's Fungi Columb. *4093*, and N. Am. Ured. *391*. Whether the species possesses aecia or not is not yet known.

The species differs from *Uromyces Jatrophae* Diet. & Holw., for which it has been mistaken and to which it is closely related, by the thicker-walled urediniospores, and the dark-beaked teliospores.

The species on the same host has also been collected on the island of Jamaica by E. W. D. Holway, Feb. 17, 1915, *211*.

30. UROMYCES CESTRI Mont. in Gay, Hist. Chile **8**: 49. 1852.
Aecidium Cestri Mont. Ann. Sci. Nat. II, **3**: 356. 1835.
Uredo Cestri Mont. Prodr. Flor. Fernandes, no. 35. 1835.
Uromycopsis Cestri Arth. Result. Sci. Congr. Bot. Vienne 345. 1906.

ON SOLANACEAE:

Cestrum laurifolium L'Her., Cabo Rojo, June 15, *2251*; Monte Alegrillo, Nov. 14, *4822*; Quebradillas, Nov. 22, *4995*; San German, Nov. 8, *5823*; Arecibo—Lares road, Jan. 21, 1914, *6787*; Arecibo, Jan. 17, 1914, *6803*.

Cestrum macrophyllum Vent., Barros, Jan. 2, *124*, *144*; Maricao, Jan. 10, 1912, *230*, April, I and III, *771*, April 3, *772*, no date, *3499*; Rio Maricao above Maricao, Sept. 20, 3640; Ponce, Nov. 8, *4353*, *4364*; Monte Alegrillo, no date, *4719*, Nov. 14, *4766*; Lares, Nov. 22, *4847*; Luguillo forest, Dec. 2, *5550*, *5605*; Monte de Oro, Dec. 3, *5713*; River junction below Utuado, Dec. 16, *6036*, Dec. 17, *6050*, Dec. 30, *6515*; Preston's ranch, Dec. 31, *6708*.

The aecia produce a considerable hypertrophy, and the peridia being evanescent, the spots soon take on the appearance of insect galls. The telia are not common, only one of the collections, no. *771*, showing a few sori on the same leaf with aecia. No pycnia of this species have yet been recorded.

The species is also known on three other West Indian islands: Jamaica, St. Jan and Tortola.

31. UROMYCES HELLERIANUS Arth. Bull. Torrey Club **31**: 2. 1904.

Nigredo Helleriana Arth. N. Am. Flora **7**: 267. 1912.

ON CUCURBITACEAE:

Cayaponia americana (Lam.) Cogn., Maricao, *723*; Cabo Rojo, Dec. 27, *6459*.

Cayaponia racemosa (Sw.) Cogn., Corozal, Feb. 21, *422*.

Melothria guadalupensis (Spreng.) Cogn., without locality or date (1913 ?), *614*; Yauco, Oct. 3, *3130*; Rosario, Oct. 27, *3840*; Utuado, Nov. 8, *4398*, *4415*; San German, Dec. 12, *5838*.

This species has not been reported outside of Porto Rico, except one collection from Guatemala, but was found on a phanerogamic specimen at the New York Botanical Garden, on *M. guadalupensis* from Buenaventura, Cuba, collected by Percy Wilson, Dec. 13, 1910, *9237*. The type collection on *C. racemosa* was obtained by A. A. Heller, on the Adjuntas road eight miles from Ponce, Dec. 4, 1902. The species has been placed in the genus *Nigredo* without knowledge of pycnia or aecia, but on the assumption that they occur whenever favorable conditions permit the life cycle to be completed.

32. UROMYCES GEMMATUS Berk. & Curt.; Berkeley, Jour. Linn. Soc. **10**: 357. 1869.

ON CONVOLVULACEAE:

Jacquemontia nodiflora (Desv.) G. Don (*Convolvulus nodiflorus* Desv.), Coamo Springs, Jan. 4, O, I, III, *42*, Feb. 1, O, II, III, *"y,"* Jan. 1, O, II, *128*, April 6, II, III, *818c*; Desecheo, May 31, II, III, *1586*; San German, Dec. 8, II, III, *5765*, Dec. 12, II, III, *5859*; Dec. 18, II, III, *4121*; Guanica, Dec. 29, II, III, *6827c*; Guayanilla, Nov. 13, II, *5928*.

The only other specimens of this exclusively West Indian rust known to the writer are one made by A. E. Ricksecker on St. Croix in 1896, listed in Millspaugh's Flora of St. Croix (Field Mus.; Bot. Ser., **1**: 466. 1902), as *Puccinia Convolvuli,* one made by E. W. D. Holway at Ponce, P. R., Jan., 1911, and one made by Holway at Kingston, Jamaica, Feb., 1915, *223*, all three showing uredinia and telia.

A specimen collected by Charles Wright in "Cuba orientali, 1856–7," which is in the Curtis set at Harvard University, is labeled "*Uredo gemmata* B. & C., var." Through the kindness of Dr. W. G. Farlow I have been able to study this collection and believe it to be identical with the material on which *Uromyces gemmatus* B. & C. was founded, which was stated to be "on the underside of leaves of *Convolvulus* etc." With the aid of Mr. Percy Wilson of the New York Botanical Garden the host has been determined with certainty as *Jacquemontia nodiflora.* The fungus consists of uredinia only, and agrees exactly with the description given by Sydow (Ann. Myc. **6**: 138. 1908), said to have been taken from a part of the type material, and also with the uredinia in the fine set of specimens collected by Dr. Stevens. A full description is given to aid in making the species better known.

Pycnia epiphyllous, few in small groups on somewhat discolored spots, inconspicuous, subepidermal, globoid-flask-shaped, 65–135 μ broad by 96–170 μ high; ostiolar filaments 25–30 μ long.

Aecia uredinoid (primary uredo), chiefly hypophyllous, circinate about the area occupied by pycnia, round or oblong, often confluent, otherwise like the uredinia.

Uredinia hypophyllous, scattered or sometimes grouped, round, about 0.5 mm. across, soon naked, cinnamon-brown, somewhat pulverulent, ruptured epidermis noticeable; urediniospores ellipsoid or obovoid, 24–27 by 31–35 μ; wall cinnamon-brown, moderately thick, 2–3 μ, prominently echinulate, the pores about 6, scattered.

Telia hypophyllous, similar to the uredinia but somewhat darker in color, often arising in the same sori; teliospores ellipsoid or obovoid, 23–29 by 32–43 μ, rounded above, somewhat narrowed below; wall cinnamon-brown, thin at sides, 1 μ, greatly thickened above, 7–20 μ, smooth; pedicel nearly or quite colorless, thin-walled, one half to once length of spore.

The *Uredo Jacquemontiae* P. Henn. from New Guinea is described as having considerably larger spores, with wall 5–7 μ thick, echinulate with hyaline points 1 μ long, and is clearly distinct from the West Indian form.

33. UROMYCES COLUMBIANUS Mayor, Mem. Soc. Neuch. Sci. Nat. 5: 467. 1913.

ON CARDUACEAE:

Melanthera canescens (Kuntze) O. E. Schultz, Ciales, June 12, 1912, *28*; Añasco, Jan. 28, *234*, *274*, Oct. 12, *3564*, *3568*; Corozal, Feb. 12, *421*; Yauco, Oct. 3, *3138*; Mayagüez, April 12, *1022*; Vega Baja, May 18, *2041*, *2045*, May 21, *1895*, *1910*, *1922*; Cayey, June 5, *2175*; Cabo Rojo, June 15, *2255*; Rosario, Oct. 27, *3837*; Utuado, Nov. 8, *4423*, *4684*; Quebradillas, Nov. 22, *5190*; San German, Dec. 12, *5831*, *5834*; Guayanilla, Nov. 13, *5917*, *5918*; River junction below Utuado, Dec. 16, *6039*, Dec. 17, *6070*, Dec. 30, *6860*, *6864*; Jayuya, Dec. 17, *6044*, *6045*.

The rust was obtained on the phanerogamic collection of the same host species made by Mr. & Mrs. A. A. Heller *138*, near Rio Piedras, P. R., May 13, 1899.

Since the work on Steven's Porto Rican rusts began, the excellent and detailed study of the rusts of the United States of Colombia by Dr. Eug. Mayor of Neuchatel, Switzerland, has been issued. In this work is a full description of the aecia, uredinia and telia, with a fairly good cut illustrating the urediniospores and teliospores of this species. The type is on *Melanthera aspera* (Jacq.) Steud., Andes centrales, dép. Antioquia, Medellin and Envigado, alt. 1550 m., II and III, August 19, no. *256*, supplemented by a number of other collections.

Pycnia occur in the Stevens collection on nos. *28*, *1910*, *1922*, *2045*, *2175* and *5917* accompanying the aecia, and probably on a number of others. In each case the collection also shows uredinia and telia. The pycnia are subepidermal, globoid or flask-shaped, inconspicuous, about 100 μ in diameter.

The rust bears the usual characters that entitle it to a place in the genus *Nigredo*, in which it becomes **Nigredo columbiana** (Mayor) comb. nov.

The host belongs to a group of forms that is difficult of separation into species. The Stevens collections are fortunately well supplied with inflorescence at various stages of maturity. Some of the material resembles *Melanthera deltoides,* and some *M. hastata cubensis,* but the careful study given to the whole set by Mr. Percy Wilson of the New York Botanical Garden, in which he was assisted by other members of the staff, makes it seem best to assign all the Stevens collections to *M. canescens.*

34. UROMYCES BIDENTIS Lagerh. Bull. Soc. France **11**: 213. 1895.

Uredo Bidentis P. Henn. Hedwigia **35**: 251. 1896.

Uredo bidenticola P. Henn. Hedwigia **37**: 279. 1898.

Uredo amaniensis P. Henn. Engler's Bot. Jahrb. **38**: 106. 1905.

ON CARDUACEAE:

Bidens leucantha Willd., Santurce, Jan. 22, *269,* June 5, *2176*; Vega Baja, Feb. 20, *470,* May 21, *1731,* Nov. 5, *4280*; Aibonito, June 5, *2146*; Añasco, Oct. 12, *3532*; Mayagüez, Oct. 31, *3952*; Monte Alegrillo, without date, *4713*; Lares, Nov. 22, *4927*; Aguada, Nov. 22, *5093*; River junction below Utuado, Dec. 30, *6583.*

Cosmos caudatus H.B.K., Barros, Jan. 2, II, *63*; Jayuya, Dec. 17, II, *5988.*

Most of the Stevens collections show uredinia only. It has been collected in Porto Rico also by E. W. D. Holway, San Juan, January, 1911, showing both uredinia and telia.

Specimens of the species have been seen from Martinique on *B. leucantha,* Hahn, and on *B. pilosa,* Sieber, and from Jamaica on *B. leucantha,* Underwood *1749,* Holway *214,* and on *Cosmos caudatus,* Underwood *1149.*

The type collection is on *Bidens andicola,* near Quito, Equador, Lagerheim, and has not been seen by the writer. A collection on the same host from Guatemala, December, 1887, J. J. Cooper, shows uredinia and telia.

The species is autoecious, and what is often called a hemi-uromyces, showing ordinarily only uredinia and telia. However, on collections by E. W. D. Holway, on *B. tereticaulis,* Jalapa, Mexico, *3210* (Barth. N. Am. Ured. *782*), and Oaxaca, Mexico, *3667,* and also by F. L. Stevens, on *B. pilosa,* Caracas, Venezuela, *3006*, there occur pycnia and uredinoid aecia (primary uredo), which give the following characters:

Pycnia amphigenous, numerous in small groups, honey-yellow becoming darker, subepidermal, globoid, 100–140 μ in diameter; ostiolar filaments few, 20–30 μ long; basidiospores large, 5–7 μ in diameter.

Aecia uredinoid, amphigenous, circinating about the groups of pycnia, resembling the uredinia, but somewhat larger and less pulverulent; aeciospores pedicellate, resembling the urediniospores.

The uredinia and telia are described elsewhere, and especially well, by Sydow, Monog. Ured. 2: 3. 1909. The characters given above entitle the species to be placed in the genus *Klebahnia*, in which it should be **Klebahnia Bidentis** (Lagerh.) nov. comb.

35. **Uromyces densus** sp. nov.

Telia hypophyllous, numerous, in small groups on slightly discolored spots, pulvinate, coalescent, all sizes from 0.1 to 1 mm. in diameter, often a central, large, cushion-shaped sorus surrounded by smaller ones, frequently in a circle, dull cinnamon-brown becoming cinereous by germination; teliospores obovoid or oblong, 16–23 by 24–38 μ; wall pale cinnamon-brown, thin, 1–1.5 μ, thicker above, 3–9 μ, smooth; pedicel nearly colorless, delicate, once or twice length of spore.

ON CARDUACEAE:

Bidens pilosa L., Ponce, Nov. 8, *4266*.

The same species was collected on *B. leucantha* at La Carmelita, P. R., April 18, 1904, by G. P. Clinton.

The species was also collected on *B. pilosa* at Caracas, Venezuela, July 15, 1913, by Dr. Stevens, *2978*, *2982*, *2998*, *3007*.

All these collections show the same characteristics of dense groups of sori, centrally cinereous from germination of the spores. The appearance is wholly unlike that of *Uromyces Bidentis* with its low, small sori, which do not coalesce and thicken into cushions. The teliospores, however, are essentially alike in the two species. *U. densus* is to be considered a short-cycle form, for which *U. Bidentis* is the corresponding long-cycle form.

(*To be continued*)